

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

FLOODS ON JONATHAN CREEK
IN VICINITY OF
MAGGIE NORTH CAROLINA

REPORT NO. 0-5486

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I.

FLOOD HISTORY

OF

JONATHAN CREEK

IN

VICINITY OF MAGGIE, NORTH CAROLINA

TO

MAY 1, 1957

4. The floods of February 21, 1953 and January 31, 1954 were the second and third highest floods known over the entire reach from Maggie to Dellwood. These were about a foot overbank on the average. Floods on March 27, 1911, February 10, 1946, January 20, 1947, November 28, 1948, and September 1, 1951, were of about the same height.

5. Damages experienced from known floods along Jonathan Creek itself have been small.

6. Substantial damage has resulted on small streams tributary to Jonathan Creek from occasional intense storms of limited extent. A severe storm of this type occurred on Fie Creek, Evans Branch, and Hemphill Creek on September 1, 1951. Another such storm occurred on Cove Creek and its branches on June 30, 1956.

7. Overflow along the main creek results from rises of approximately 5 feet above low water. The width of overflow in the flood of February 1953 was about 200 to 300 feet.

8. There are 11 private bridges and 5 highway bridges across Jonathan Creek in the reach from Maggie to Dellwood. Most bridges are higher than past floods and have not constituted any serious obstruction to flow in the creek.

JONATHAN CREEK BASIN

Settlement and Developments

Settlement of the Jonathan Creek valley dates back to the early 1800's. The creek gets its name from one of the first settlers who lived in the Hemphill Creek section north of Dellwood. A post office at the mouth of Hemphill Creek was called Jonathan Creek and later Jonathan. Other old settlers of the valley were the Plots, Setzers, Henrys, and Fergusons, names that are still found among the area residents.

There are no large towns in the watershed. Dellwood, one of the early settlements, had a 1950 population of 160. Maggie, named in honor of Maggie Setzer, daughter of the first postmaster, had 100 residents in 1950. Cove Creek, near the mouth of Jonathan Creek, also has a population of 100.

Maggie and Dellwood are on U. S. Highway 19, principal access road leading westward from Asheville across Soco Gap to the Cherokee Indian Reservation and the Great Smoky Mountains National Park. North Carolina Highway 284, serving the lower end of the watershed, joins Highway 19 at Dellwood.

The Creek and Its Valley

The Jonathan Creek watershed shown on Plate 1 has a total drainage area of 66.4 square miles. The drainage area above the gaging station near Cove Creek, Mile 0.67, is 65.3 square miles, above Dellwood, Mile 9.7, 34.8 square miles, and above Maggie, Mile 14.0, 22.3 square miles. Above Dellwood the watershed is 8 miles long by about 4 miles wide and is mostly forested. Jonathan Creek, flowing eastward, bisects the area. Numerous small branches enter the main stem from the steep north and south slopes.

Jonathan Creek heads on the high ridges that form the western boundary of Haywood County. Elevations along these ridges range up to 6292 on Waterrock Knob, 6200 on Jones Knob, and 6088 on Plott Balsam. Much of the watershed boundary above Dellwood is more than one mile above sea level. The elevation at Maggie is about 3000 and at Dellwood 2750.

The average fall of the creek in the 4.3-mile reach from Maggie to Dellwood is 63 feet per mile. The average over the entire 14 miles from Maggie to the mouth in Pigeon River is 45 feet per mile. The banks in the Maggie-Dellwood reach are about 5 feet above the stream bed. The flood plain that would be inundated by floods that could conceivably happen on this creek ranges up to 1500 feet wide. However, none of the present residents have observed overflows of more than 200 to 300 feet in width.

The soil in the creek bottoms is productive although containing numerous boulders. These boulders are turned up at each plowing and are in some cases hauled from the fields to the creek bank where they serve in some slight measure to restrain floods. The boulders are also used as building material.

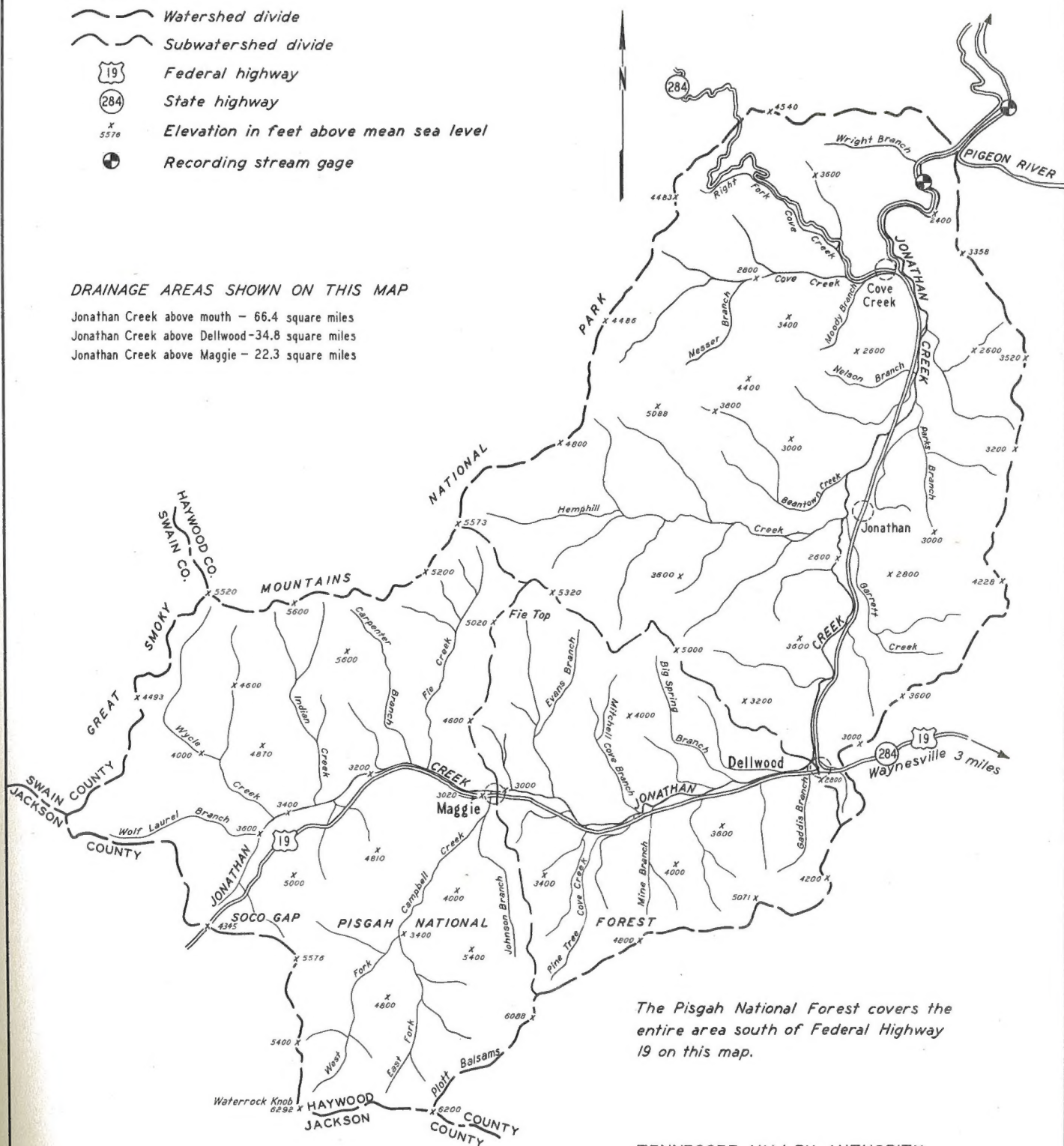
Some channel improvement work has been undertaken by property owners along the creek. This has been relatively inexpensive work by bulldozers in which the boulders in the stream bed have been pushed back

LEGEND:

-  Watershed divide
-  Subwatershed divide
-  Federal highway
-  State highway
-  Elevation in feet above mean sea level
-  Recording stream gage

DRAINAGE AREAS SHOWN ON THIS MAP

Jonathan Creek above mouth - 66.4 square miles
Jonathan Creek above Dellwood - 34.8 square miles
Jonathan Creek above Maggie - 22.3 square miles



The Pisgah National Forest covers the entire area south of Federal Highway 19 on this map.

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH

JONATHAN CREEK WATERSHED

Scale 0 1 2 3 4 5 Miles

MAY 1954

to widen and deepen the channel. Reaches where work of this type has been done are as follows: Mile 9.57 to 9.60, Mile 12.28 to 12.53, Mile 13.10 to 13.45, Mile 13.62 to 13.65, and Mile 14.30 to 14.32. In addition, gravel removal operations in the vicinity of Mile 10.2 and 13.2 has substantially increased the channel size at these two points. Most of this channel work has been done since the February 1953 flood.

Development of Tourist Facilities

An active development of tourist facilities began in the area about eight years ago when U. S. Highway 19 was relocated to its present alignment up Jonathan Creek and through Soco Gap. The first enterprise of this type was Mountain Valley Inn, the location of which is shown on Plate 2 at Mile 12.4. Since then new tourist courts, shops, and cafes have been built each year along the highway.

The Maggie Valley Development Association was organized a few years ago by the residents of the area, and the members are cooperating in planning and in advertising. A primary aim of the Association is to promote development with careful planning. The Department of City and Regional Planning of the University of North Carolina spent several months in a study of the problems of the valley early in 1954 and prepared a suggested general plan for orderly and effective development. This plan did not consider the local flood picture as outlined herein as flood data were not available at the time.

Bridges Across the Creek

A large number of bridges cross Jonathan Creek in the reach under investigation. From Mile 9.0 below Dellwood to Mile 15.0 above Maggie there are 5 state-owned bridges, 11 private bridges, and a footbridge. The floors of most of these bridges are less than 10 feet above low water level. Table 1 lists the bridges and shows elevation of bridge floor, low water and approximate 1953 flood crest level where these data are available.

TABLE 1
JONATHAN CREEK BRIDGE DATA
MAGGIE - DELLWOOD REACH

<u>Mile</u>	<u>Ownership</u>	<u>Elevations</u>			
		<u>Low Water</u>	<u>Bridge Floor</u>	<u>Feet Above 1953 Flood</u>	<u>1953 Flood Crest</u>
9.19	Private bridge				
9.43	Private bridge	2714.8	2721.0	0	2721
9.65	Private bridge			-	2731
9.87	Footbridge			-	2741
10.42	State bridge	2765.2	2774.7	4.5	2770.2
11.24	Private bridge	2809.9	2816.4	1.8	2814.6
12.16	State bridge	2862.8	2873.1	5.3	2867.8
12.53	Private bridge	2885.7	2890.7	-0.7	2891.4
12.63	Private bridge	2892.9	2901.0	4.6	2896.4
12.98	Private bridge			-	2918.9
13.42	State bridge	2948.4	2955.8	2.7	2953.1
13.62	Private bridge	2966.4	2971.2	2.0	2969.2
13.95	State bridge	2992.5	3002.2	7.4	2994.8
14.29	Private bridge	3029.7	3035.5	2.1	3033.4
14.52	Private bridge	3050.2	3055.1	-0.9	3056.0
14.68	State bridge	3076.9	3081.7	0.1	3081.6
14.83	Private bridge	3093.8	3104.8	-	

FLOOD DATA

Flood Records

The U. S. Geological Survey has operated a gaging station on Jonathan Creek near Cove Creek, nine miles downstream from Dellwood, since May 24, 1930. Data on flood crest stages and discharges near the mouth of the creek are available from these records. These data afford an index to floods in the Maggie-Dellwood reach. However, because of the difference in drainage areas at Maggie and Cove Creek and the considerable variation in storm precipitation that is possible in this mountain area, the gage record may not reflect all floods in the Maggie-Dellwood reach.

To develop information on flood heights and flood history in this reach, local residents were interviewed and previous investigations made by the Hydraulic Data Branch of storms and floods in the area were reviewed. Since floods of recent years have caused little damage along Jonathan Creek, residents are not very flood conscious. Few residences or farm buildings have been reached by floods. As a result, local people are likely to recall the height of only the most recent large flood, and there is a tendency to lump past floods together as being of about the same height. Fortunately, the significant flood of February 21, 1953, was still fresh in the minds of most of the people in the reach, and data on this flood are fairly complete.

Flood Stages and Discharges

The accompanying Table 2 lists stages and discharges for all floods exceeding six feet at the gaging station near Cove Creek since May 24, 1930. Also shown are dates for two prerecord floods, and for two floods of record that were high in the Maggie-Dellwood reach but did not reach six feet at the gage near Cove Creek. In the right hand columns of the table are listed estimated peak discharges for the various floods at Maggie and Dellwood. These discharges were determined from the flows near Cove Creek by multiplying the Cove Creek flows by the ratio of the square root of the drainage areas.

TABLE 2

PEAK STAGES AND DISCHARGESJONATHAN CREEK NEAR COVE CREEK, MAGGIE AND DELLWOOD, N. C.1911 to 1957

<u>Date of Crest</u>	<u>Near Cove Creek (65.3 Sq. Mi.)</u>			<u>Estimated Peak Discharge</u>			
	<u>Stage</u>	<u>Peak Discharge</u>		<u>At Maggie (22.3 Sq. Mi.)</u>		<u>At Dellwood (34.8 Sq. Mi.)</u>	
		<u>Amount</u>	<u>Per Sq.</u>	<u>Amount</u>	<u>Per Sq.</u>	<u>Amount</u>	<u>Per Sq.</u>
	<u>feet</u>	<u>cfs</u>	<u>Mile</u>	<u>cfs</u>	<u>cfs</u>	<u>cfs</u>	<u>cfs</u>
Feb. 28, 1902							
Mar. 27, 1911				1,600	72	2,000	58
Jan. 19, 1936	6.20	2,270	35	1,300	58	1,700	49
Feb. 3, 1939	6.02	2,120	33	1,200	54	1,600	46
Aug. 13, 1940	6.08	2,190	34	1,300	58	1,600	46
Aug. 30, 1940	7.51	3,200	49	1,900	85	2,300	66
Feb. 10, 1946	6.75	2,680	41	1,600	72	2,000	58
Jan. 20, 1947	6.96	2,820	43	1,700	76	2,100	60
Nov. 28, 1948				1,700	76	1,800	52
Sept. 1, 1951				1,700	76	1,800	52
Feb. 21, 1953	6.90	2,750	42	1,600	72	2,000	58
Jan. 22, 1954	6.08	2,180	34	1,300	58	1,600	46
Jan. 31, 1957	7.33	3,070	47	1,800	81	2,200	63

Flooded Area

Plate 2 shows the approximate area that was overflowed in February 1953 in the reach between Maggie and Dellwood. This area has been outlined from data collected in April 1954 based on the high water profile and the topography on the map. Since the contour interval of the map is 40 feet, some variation is to be expected between the overflow limits as shown on the map and that which actually occurred.

Evidence of Past Floods

Although the width of overflow of past floods recorded or within the memory of local residents is only 200 to 300 feet in width, the main valley floor is wider than this, varying up to about 1500 feet. Examination of this valley floor shows that it has a high content of stream deposited rocks and small boulders. These were probably deposited by floods that have occurred in the Jonathan Creek valley in the past.

Flood Profile

Plate 3 shows the high water profile for the flood of February 1953 based on high water marks pointed out by local residents. The marks for the flood of January 31, 1957, shown on Plate 3 were determined by Hydraulic Data Branch engineers in the field immediately following the flood. A few high water marks were located for floods in March 1911, August 1940, and other floods, but these were insufficient in number to develop profiles for the older floods. Also shown on Plate 3 are the profile of the creek banks and the approximate low water of April 1954.

Flood Descriptions

The following descriptions of floods on Jonathan Creek cover some of the more important floods for which data are available:

February 28, 1902 - A very large flood occurred on the lower Pigeon River on February 28, 1902. Investigation of this flood showed that the lower tributaries, notably Jonathan and Richland Creeks, contributed heavily to the river flood. No specific data on the Jonathan Creek flood are available.

March 27, 1911 - H. M. Plott, who has lived for 60 years at the old Plott place at Mile 12.0, recalled two large floods of equal height, one on March 27, 1911, and one in February 1953. Streamflow records for Pigeon River at Newport and for other streams in the general area show a small rise on March 27 and 28, 1911. Probably the flood that Mr. Plott recalled resulted from an intense local thunderstorm. There was no evidence in newspaper accounts or other flood history data of general flood conditions on this date. Grady Henry, who lives at Mile 14.3, also recalled a high flood about 40 years ago which may have been the 1911 rise.

August 30, 1940 - This flood was the largest in the 24 years of record at the gaging station near Cove Creek and the largest known to local residents in the reach between Dellwood and about Mile 13. At the gaging station this rise was one-half foot higher than any other flood of record. At Mile 10.9, A. J. Moody and Merlin Evans said that the 1940 crest was the highest in 30 to 40 years and that it exceeded the 1953 height by one-half to one foot. Above Mile 13 the 1940 flood was about the same as the 1953 rise or slightly lower.

November 28, 1948 - According to R. F. Hall, caretaker at the Rocky Waters Court, Mile 14.8, the highest flood at that location in the last seven years occurred in November 1948. No mention was made of this flood below Maggie, and it was apparently important only in the extreme headwaters.

September 1, 1951 - Late on the afternoon of September 1, 1951, an intense thunderstorm with up to 6.5 inches of rain in one hour fell on the Fie Creek, Evans Branch, and Hemphill Creek watersheds in the upper Jonathan Creek basin. The center of the storm was on the mountain slopes about 4 miles north of Maggie. Discharges during this storm were as follows:

<u>Stream</u>	<u>Drainage Area sq.miles</u>	<u>Discharge</u>	
		<u>Total cfs</u>	<u>Per Square Mile cfs</u>
Fie Creek	2.06	1,000	490
Evans Branch	2.11	310	150
Hemphill Creek	2.74	1,700	620

Only small rises occurred on the other tributaries above Dellwood, however, and the flood on Jonathan Creek was important only between Maggie and Fie Creek which enters at Mile 14.87. Frank Setzer, who has lived near Mile 14.7 all his life, said the 1951 rise was the highest he had seen above Maggie. R. F. Hall, who furnished information on the 1948 flood, thought the 1951 crest was slightly lower than 1948.

February 21, 1953 - There was fairly general agreement that the February 1953 flood was the highest in recent years below Maggie. Campbell Creek, which enters from the south at Maggie, reached its highest stage in many years. It was principally the contribution from Campbell Creek and the other streams along the south side of the basin that produced this flood.

The 1953 overflow is shown on Plate 2. The extent of overflow is also shown on the valley cross sections, Plate 4. This overflow was generally shallow and caused no damages of consequence.

January 31, 1957 - At this time a flood occurred which at the U. S. Geological Survey gaging station near Cove Creek, N. C. was the second highest in the 27 years of record and only a few inches lower than the flood of August 1940. In the vicinity of Maggie and Dellwood, high water marks indicate the flood was about the same height as that of February 21, 1953. Damages from the 1957 overflow were insignificant.

ACKNOWLEDGMENTS

This report has been prepared by personnel of the Hydraulic Data Branch, Division of Water Control Planning, under the general direction of James S. Bowman, formerly Chief Water Control Planning Engineer and Reed A. Elliot, Chief Water Control Planning Engineer, and the immediate supervision of Albert S. Fry, Chief, Hydraulic Data Branch.

Field investigations, made under the direction of James W. Beverage, Head of the Field Investigations Section, were carried out by Myron O. Jensen, District Engineer, and James K. Curtis, Area Engineer. Mr. Jensen prepared the field report on the investigation.

Flood information was analyzed and this report was prepared by James Smallshaw, Head of the Hydraulic Investigations Section.

II.

MAXIMUM

REASONABLE REGIONAL EXPECTANCY FLOOD

JONATHAN CREEK

IN VICINITY OF

MAGGIE, NORTH CAROLINA

Tennessee Valley Authority
Division of Water Control Planning

MAXIMUM REASONABLE REGIONAL EXPECTANCY FLOOD

JONATHAN CREEK

IN VICINITY OF

MAGGIE, NORTH CAROLINA

The preceding section has presented an account of floods that have occurred in the vicinity of Maggie, North Carolina. Along with such historical floods, it is important to consider the magnitude and effect of floods that may occur in the future, particularly those that may reasonably be expected to occur on Jonathan Creek near Maggie. It is with the maximum flood of reasonable regional expectancy near Maggie and the effects of that and other large floods that this section is chiefly concerned.

Maximum Flood of Reasonable Regional Expectancy

Determination--Determination has been made of the peak flood discharge, velocities, and elevations of the water surface at the flood crest for a maximum flood that may reasonably be expected to occur on Jonathan Creek in the vicinity of Maggie, North Carolina. In these determinations, consideration has been given to (1) great storms which have already occurred in the general vicinity of the Jonathan Creek basin and of observed rainfall in the vicinity of Maggie and (2) the greatest flood discharges that are known to have occurred on streams in the general region of Maggie. As a result of these studies, the maximum flood of reasonable regional expectancy has been determined to have a discharge of about 29,000 cubic feet per second at Dellwood at the lower end of the 4-mile reach of Jonathan Creek immediately downstream from Maggie.

Water surface elevations for such a flood have been computed using stream characteristics for selected reaches as determined from

topographic maps, valley cross sections, and observed floods. Average velocities of flow in the channel and in the overflow areas also have been computed.

Comparison with Past Floods--This flood would be considerably larger in peak discharge than the flood of February 1953 or any flood known to have occurred on Jonathan Creek. It would be from 5 to 10 feet higher than the flood of 1953 through the reach from Maggie to Dellwood.

Frequency--The frequency of this flood is not susceptible of definite determination. Over perhaps several centuries of record, the maximum flood of reasonable regional expectancy will occur on the average only at rather long intervals of time, but such a flood could occur this year, next year, or in any succeeding year.

Larger Floods Possible

Larger floods than the maximum of reasonable regional expectancy are meteorologically possible. However, the combination of meteorological factors that would be necessary to produce such floods would occur at very rare intervals. Although the possibility of floods of this magnitude are of greater importance in some flood problems than in others, and should not be overlooked in the study of any flood problem, such floods, because of their rarity and uncertainty of occurrence usually need not be given significant consideration in zoning to reduce flood damage.

Crest Profile and Overflow Areas

The crest profile for the maximum flood of reasonable regional expectancy is shown on Plate 3.

The limits of the area that would be overflowed by the flood are shown on Plate 2. The horizontal area covered by the flood is considerably more than that covered by the flood of February 1953. This maximum flood of reasonable regional expectancy would cover nearly all of the flatter bottomland and portions of U. S. Highway 19 that runs through Maggie Valley. Even a flood only one-half the flood of reasonable regional expectancy would cover a major part of the bottomland.

While the elevations and areas overflowed shown on Plates 2 and 3 are sufficiently accurate for the intended purpose, actual elevations for a flood of the magnitude of this one may vary somewhat from those shown on the profile and map. The contour interval of the map is 40 feet which does not permit precise plotting of the boundaries of the flooded areas so that the actual positions on the ground of the flooded areas may vary from those shown on the map. To determine flood elevations and limits with a higher degree of accuracy would require costly surveys and studies which present purposes do not warrant.

Velocities and Depths of Inundation

The average fall of Jonathan Creek in this reach from Maggie to Dellwood is 63 feet per mile. Due to this steep slope, the velocities in the stream are swift. Average velocities and depths in the maximum flood of reasonable regional expectancy in the channel and overflow areas for three locations between Dellwood and Maggie are as follows:

<u>Location</u>	<u>Velocity (Ft/sec.)</u>		<u>Depth (Feet)</u>	
	<u>Channel</u>	<u>Overflow Area</u>	<u>Channel</u>	<u>Overflow Area</u>
Mile 10.06	20	6	11	8
Mile 12.63	23	6	11	8
Mile 13.95	14	8	12	6

The three locations were selected to show representative average flow conditions in the vicinity of existing development. Two of the sections, Mile 12.63 and Mile 13.95, are given on Plate 4. In all, 27 valley cross-sections were obtained to supplement the topographic data available from the USGS-TVA topographic maps, as the contour interval on those maps is 40 feet. These cross sections permitted more accurate determinations of flows, velocities, and depths than from the maps alone. Depths of overflows at several other sections are shown on Plate 4.

Plate 2 shows ground elevations at several points along each of the valley cross sections and also the elevation of the maximum flood of reasonable regional expectancy. The difference between the

ground elevation at any point and the flood elevation gives the depth of flooding at that point.

High velocities will occur even in much smaller floods. For example, at the three locations shown above, a flood one-half the discharge of the maximum flood would still have velocities only one or two feet per second less than those for the maximum flood, and depths only one to three feet less.

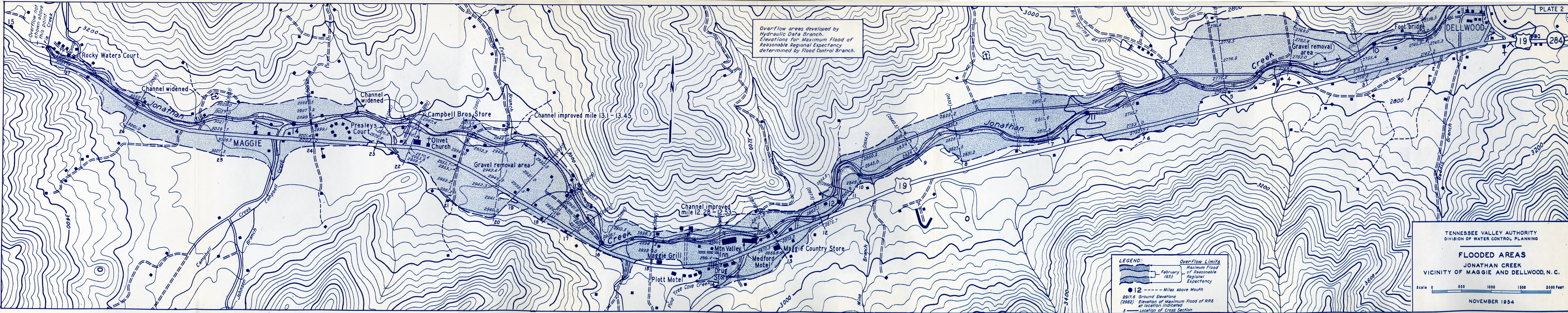
Even less than bankfull flows pass down the channel at dangerously rapid velocities.

Rate of Rise

The shape as well as the slope of the drainage area above Maggie is quite conducive to rapid runoff. Dangerously rapid rates of rise in Jonathan Creek can be expected. Records of intense storms over similar areas in the region indicate that crest stages for a maximum flood of reasonable regional expectancy or any large flood can be expected within four to six hours after the intense rainfall begins. Such a storm and flood, therefore, could develop without warning during the night hours.

Acknowledgments

Determination of the magnitude of the maximum flood of reasonable regional expectancy and others was made by the Flood Control and Hydraulic Data Branches of the Division of Water Control Planning under the general direction of James S. Bowman, Chief Water Control Planning Engineer, and the immediate supervision of Charles W. Okey, Chief, Flood Control Branch, and Albert S. Fry, Chief, Hydraulic Data Branch. For the Hydraulic Data Branch, flood studies were under the direction of Alfred J. Cooper, Head, Hydrology Section, and for the Flood Control Branch, flood studies were under the direction of Edward J. Rutter, Head, Project Studies Section, and computation of water surface elevations and velocities was under the direction of B. J. Buehler, Head, Operations Studies Section.

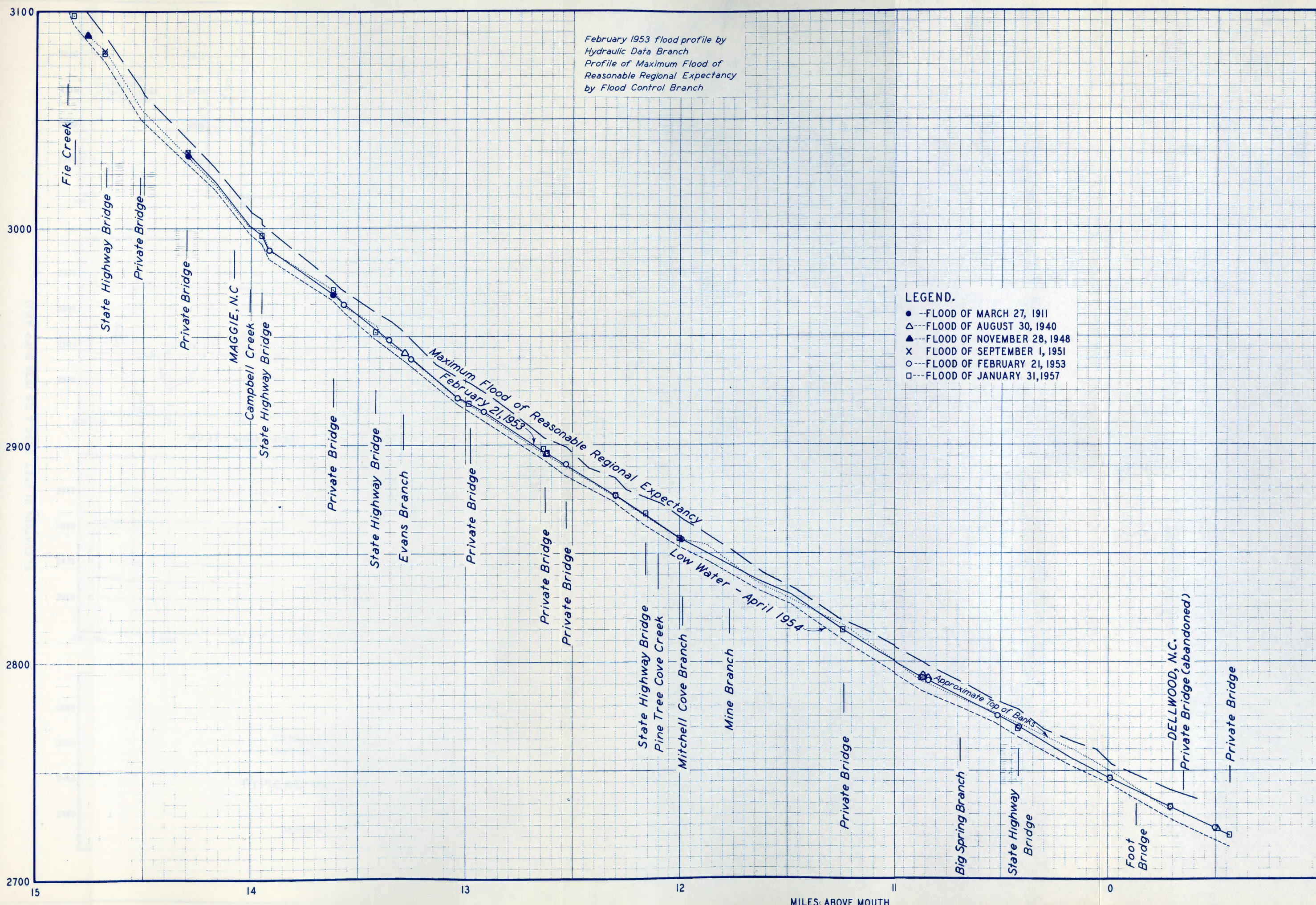


Overflow areas developed by Hydraulic Data Branch. Elevations for Maximum Flood of Reasonable Regional Expectancy determined by Flood Control Branch.

LEGEND:
Overflow Limits
Maximum Flood of Reasonable Regional Expectancy
February 1953
Miles above Mouth
Ground Elevations
Elevation of Maximum Flood of RRE at location indicated
Location of Cross Section

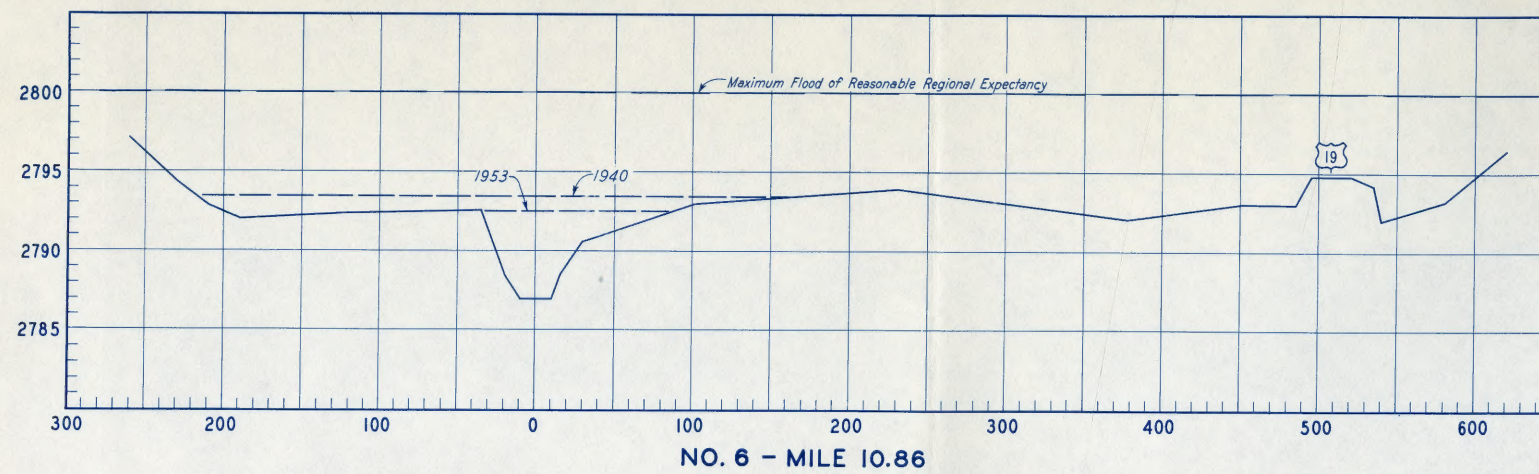
TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
FLOODED AREAS
JONATHAN CREEK
VICINITY OF MAGGIE AND DELLWOOD, N. C.
Scale 0 500 1000 1500 2000 Feet
NOVEMBER 1954

ELEVATION IN FEET (USC&GS 1936 SUPPL. ADJ.)

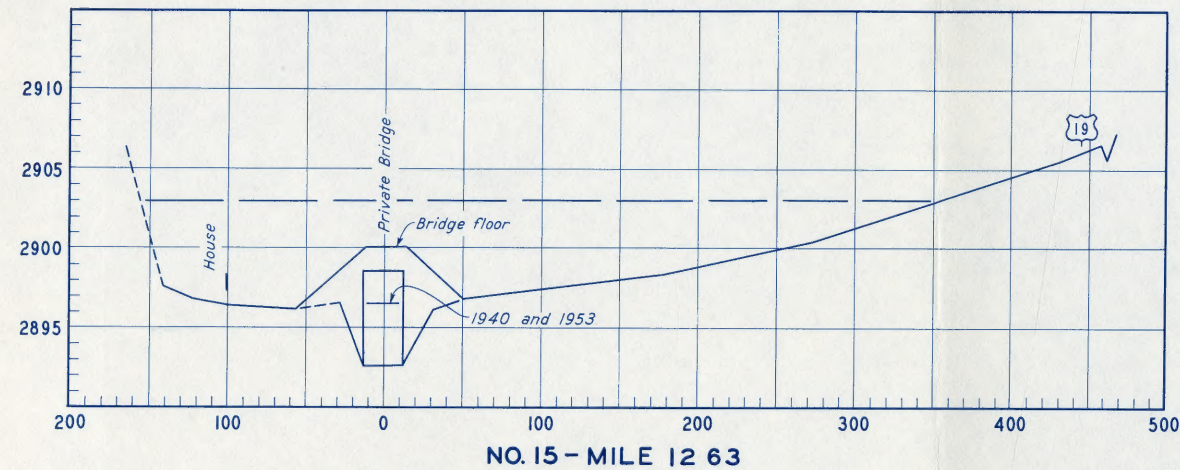
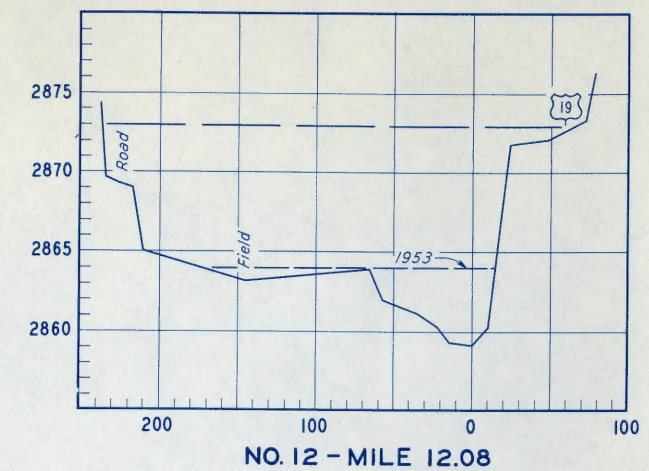


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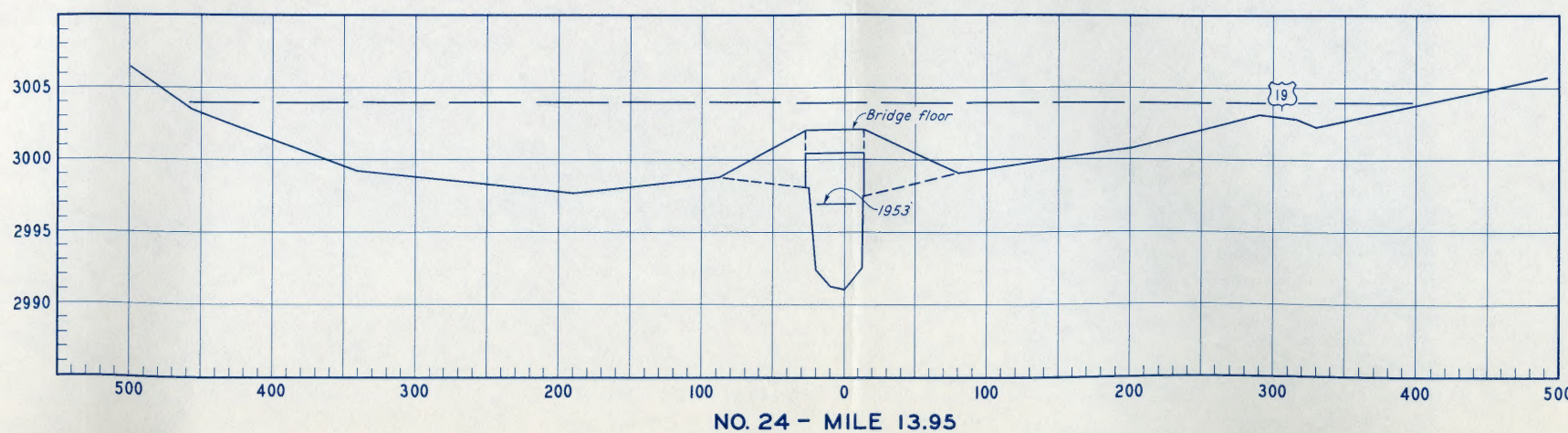
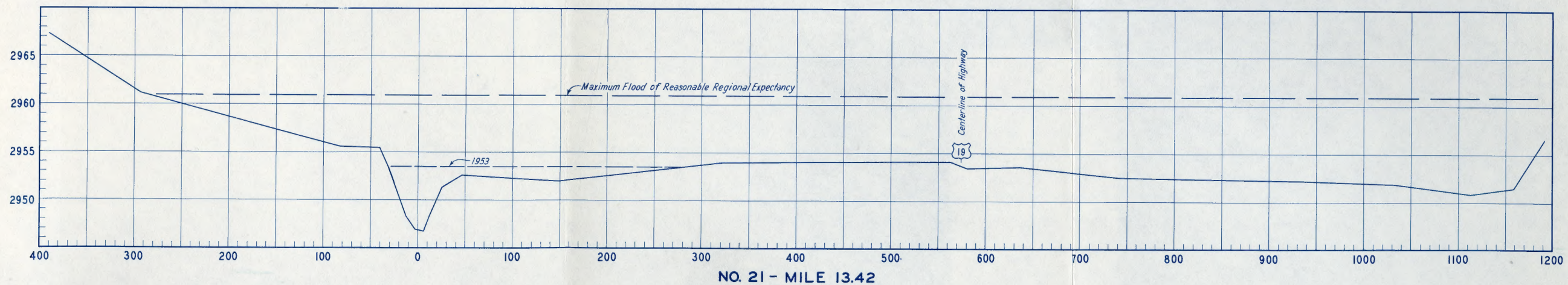
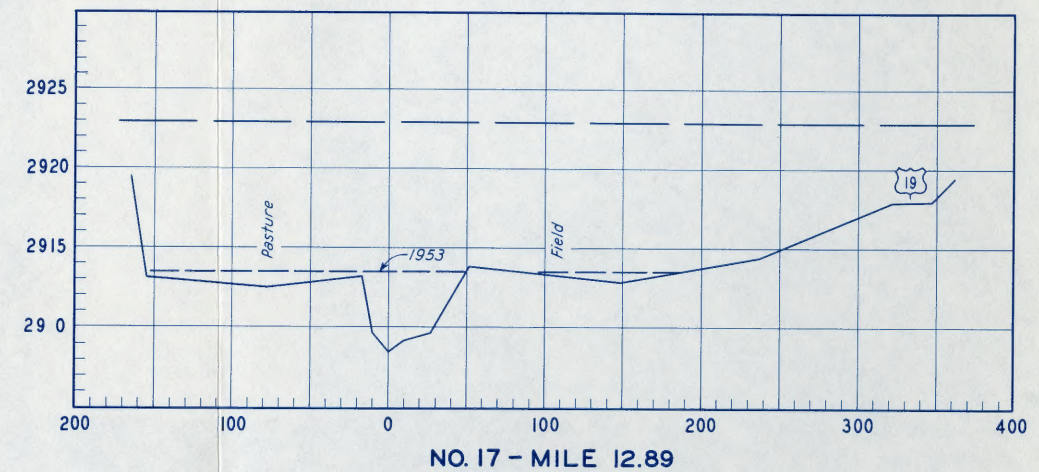
HIGH WATER PROFILES
JONATHAN CREEK
VICINITY OF
MAGGIE AND DELLWOOD, N.C.
MAY 1957



Valley cross sections and historic flood elevations by Hydraulic Data Branch. Elevations of Maximum Flood of Reasonable Regional Expectancy determined by Flood Control Branch.



Sections taken looking downstream



HORIZONTAL DISTANCE IN FEET

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
TYPICAL VALLEY CROSS SECTIONS
JONATHAN CREEK
VICINITY OF
MAGGIE AND DELLWOOD, N. C.
NOVEMBER 1954